

CPC**COOPERATIVE PATENT CLASSIFICATION****B21B**

ROLLING OF METAL (auxiliary operations used in connection with metal-working operations covered in [B21](#) , see [B21C](#) ; bending by rolling [B21D](#) ; manufacture of particular objects, e.g. screws, wheels, rings, barrels, balls, by rolling [B21H](#) ; pressure welding by means of a rolling mill [B23K 20/04](#))

NOTE

In this subclass, the following terms or expressions are used with the meanings indicated:- "rolling" means rolling operations in which plastic deformations occur;- "continuous process" means a process employing a mill train designed to have the workpiece enter one pair of rolls before leaving the preceding pair.

Guide heading:**B21B 1/00**

Metal-rolling methods or mills for making semi-finished products of solid or profiled cross-section ([B21B 17/00](#) to [B21B 23/00](#) take precedence; with respect to composition of material to be rolled [B21B 3/00](#) ; extending closed shapes of metal bands by simultaneous rolling at two or more zones [B21B 5/00](#) ; metal-rolling stands as units [B21B 13/00](#) ; continuous casting into moulds having walls formed by moving rolls [B22D 11/06](#))

Sequence of operations in milling trains

Layout of rolling-mill plant, e.g. grouping of stands

Succession of passes or of sectional pass alternations

- [B21B 1/02](#) . for rolling heavy work, e.g. ingots, slabs, { blooms } billets, in which the cross-sectional form is unimportant { Rolling combined with forging or pressing }
- [B21B 1/024](#) .. { Forging or pressing (forging or pressing devices as units [B21B 15/0035](#)) }
- [B21B 1/026](#) .. { Rolling }
- [B21B 1/04](#) .. in a continuous process
- [B21B 1/06](#) .. in a non-continuous process, { e.g. triplet mill, reversing mill }
- [B21B 1/08](#) . for rolling { structural sections, i.e. } work of special cross-section, e.g. angle steel (rolling metal of indefinite length in repetitive shapes specially designed for the manufacture of particular objects [B21H 8/00](#))
- [B21B 1/0805](#) .. { Flat bars, i.e. having a substantially rectangular cross-section }
- [B21B 1/0815](#) .. { from flat-rolled products, e.g. by longitudinal shearing }
- [B21B 1/082](#) .. Piling sections having lateral edges specially adapted for interlocking with each other in order to build a wall
- [B21B 1/085](#) .. Rail sections
- [B21B 1/0855](#) ... { Rerolling or processing worn or discarded rail sections }
- [B21B 1/088](#) .. H- or I-sections
- [B21B 1/0883](#) ... { using forging or pressing devices }
- [B21B 1/0886](#) ... { using variable-width rolls }
- [B21B 1/09](#) .. L-sections

- B21B 1/092 .. T-sections
- B21B 1/095 .. U-or channel sections
- B21B 1/098 .. Z-sections

WARNING

Groups [B21B 1/098](#) is not complete. See also other subgroups of [B21B 1/08](#)

- B21B 1/10 .. in a single two-high or universal rolling mill { stand ([B21B 1/085](#) to [B21B 1/098](#) take precedence) }
- B21B 1/12 .. in a continuous process, { i.e. without reversing stands ([B21B 1/085](#) to [B21B 1/098](#) take precedence) }
- B21B 1/14 .. in a non-continuous process, { i.e. at least one reversing stand ([B21B 1/085](#) to [B21B 1/098](#) take precedence) }
- B21B 1/16 . for rolling { wire rods, bars, merchant bars, rounds } wire or material of like small cross-section
- B21B 1/163 .. { Rolling or cold-forming of concrete reinforcement bars or wire (reinforcement bars per se [E04C 5/03](#)) ; Rolls therefor }
- B21B 1/166 .. { Rolling wire into sections or flat ribbons }
- B21B 1/18 .. in a continuous process
- B21B 1/20 .. in a non-continuous process, (e.g. skew rolling, i.e. planetary cross rolling)
- B21B 1/22 . for rolling { plates, strips, } bands or sheets of indefinite length ([B21B 1/42](#) takes precedence)
- B21B 1/222 .. { in a rolling-drawing process; in a multi-pass mill }
- B21B 1/224 .. { Edge rolling of flat products }
- B21B 1/227 .. { Surface roughening or texturing }
- B21B 1/24 .. in a continuous { or semi-continuous } process { ([B21B 1/224](#) takes precedence) }
- B21B 1/26 ... by hot-rolling, { e.g. Steckel hot mill }
- B21B 1/265 { and by compressing or pushing the material in rolling direction }
- B21B 1/28 ... by cold-rolling, { e.g. Steckel cold mill }
- B21B 1/30 .. in a non-continuous process { ([B21B 1/224](#) takes precedence) }
- B21B 1/32 ... in reversing { single stand } mills, e.g. with intermediate storage reels for accumulating work
- B21B 1/34 by hot-rolling
- B21B 1/36 by cold-rolling
- B21B 1/38 . for rolling sheets of limited length, e.g. folded sheets, superimposed sheets, { pack rolling } ([B21B 1/40](#) takes precedence; folding sheets before, or separating layers after, rolling [B21B 47/00](#))
- B21B 1/40 . for rolling foils which present special problems, e.g. because of thinness
- B21B 1/42 . for step-by-step or planetary rolling (making tubes by pilgrim-step rolling [B21B 21/00](#))
- B21B 1/46 . for rolling metal immediately subsequent to continuous casting (metal-rolling stands [B21B 13/22](#) ; continuous casting [B22D 11/00](#) , e.g. into moulds with rolls [B22D 11/06](#))
- B21B 1/463 .. { in a continuous process, i.e. the cast not being cut before rolling }

- B21B 1/466 . . { in a non-continuous process, i.e. the cast being cut before rolling }
- B21B 3/00** **Rolling materials of special alloys so far as the composition of the alloy requires or permits special rolling methods or sequences** { Rolling of aluminium, copper, zinc or other non-ferrous metals } (altering special metallurgical properties of alloys, other than structure consolidation or mechanical properties resulting therefrom [C21D](#) , [C22F](#))
- B21B 3/003 . { Rolling non-ferrous metals immediately subsequent to continuous casting, i.e. in-line rolling }
- B21B 3/02 . Rolling special iron alloys, { e.g. stainless steel }
- B21B 5/00** **Extending closed shapes of metal bands by rolling** (manufacture of circular shapes, e.g. wheel rims, [B21H 1/06](#))
- B21B 9/00** **Measures for carrying out rolling operations under special conditions, e.g. in vacuum or inert atmosphere to prevent oxidation of work**
Special measures for removing fumes from rolling mills
- B21B 11/00** **Subsidising the rolling process by subjecting rollers or work to vibrations, { e.g. ultrasonic vibrations }**
- B21B 13/00** **Metal-rolling stands, i.e. an assembly composed of a stand frame, rolls, and accessories** ([B21B 17/00](#) to [B21B 23/00](#) take precedence; details, component parts, accessories, auxiliary means, procedures in connection with metal rolling, see the relevant groups)
- B21B 13/001 . { Convertible or tiltable stands, e.g. from duo to universal stands, from horizontal to vertical stands }
- B21B 13/005 . { Cantilevered roll stands }
- B21B 13/008 . { Skew rolling stands, e.g. for rolling rounds }
- B21B 13/02 . with axes of rolls arranged horizontally
- B21B 13/023 . . { the axis of the rolls being other than perpendicular to the direction of movement of the product, e.g. cross-rolling }
- B21B 13/04 . . Three-high arrangement
- B21B 13/06 . with axes of rolls arranged vertically, { e.g. edgers }
- B21B 13/08 . with differently-directed roll axes, e.g. for the so-called "universal" rolling process
- B21B 13/10 . . all axes being arranged in one plane
- B21B 13/103 . . . { for rolling bars, rods or wire }
- B21B 13/12 . . axes being arranged in different planes
- B21B 13/14 . having counter-pressure devices acting on rolls to inhibit deflection of same under load; { [Back-up rolls](#) } (counter-pressure devices as such [B21B 29/00](#))

- B21B 13/142 . . { by axially shifting the rolls, e.g. rolls with tapered ends or with a curved contour for continuously-variable crown CVC }
- B21B 13/145 . . { Lateral support devices for rolls acting mainly in a direction parallel to the movement of the product }
- B21B 13/147 . . { Cluster mills, e.g. Sendzimir mills , Rohn mills, i.e. each work roll being supported by two rolls only arranged symmetrically with respect to the plane passing through the working rolls }
- B21B 13/16 . with alternatively operative rolls, { e.g. revolver stands, turret mills }
- B21B 13/18 . for step-by-step or planetary rolling; { pendulum mills } (methods [B21B 1/42](#) ; making tubes by pilgrim-step rolling [B21B 21/00](#))
- B21B 13/20 . . for planetary rolling
- B21B 13/22 . for rolling metal immediately subsequent to continuous casting, { i.e. in-line rolling of steel } (methods therefor [B21B 1/46](#) ; continuous casting [B22D 11/00](#) , e.g. into moulds with rolls [B22D 11/06](#))
- B21B 15/00** **Arrangements for performing additional metal-working operations specially combined with or arranged in, or specially adapted for use in connection with, metal-rolling mills**
- B21B 15/0007 . { Cutting or shearing the product }
- B21B 15/0035 . { Forging or pressing devices as units }
- B21B 15/0042 . . { Tool changers }
- B21B 15/005 . . { Lubricating, cooling or heating means }
- B21B 15/0085 . { Joining ends of material to continuous strip, bar or sheet }
- B21B 15/02 . in which work is subjected to permanent internal twisting, e.g. for producing reinforcement bars for concrete
- Guide heading:** **Rolling methods or mills specially designed for making or processing tubes (control of tube rolling [B21B 37/78](#))**
- B21B 17/00** **Tube-rolling by rollers of which the axes are arranged essentially perpendicular to the axis of the work, e.g. "axial" tube-rolling**
- B21B 17/02 . with mandrel, { i.e. the mandrel rod contacts the rolled tube over the rod length } ([B21B 17/08](#) takes precedence)
- B21B 17/04 . . in a continuous process
- B21B 17/06 . . in a discontinuous process
- B21B 17/08 . with mandrel having one or more protrusions, { i.e. only the mandrel plugs contact the rolled tube; Press-piercing mills }
- B21B 17/10 . . in a continuous process
- B21B 17/12 . . in a discontinuous process, { e.g. plug-rolling mills }

- B21B 17/14
 - . without mandrel, { e.g. stretch-reducing mills }
- B21B 19/00**

Tube-rolling by rollers arranged outside the work and having their axes not perpendicular to the axis of the work (straightening by rollers [B21D](#))
- B21B 19/02
 - . the axes of the rollers being arranged essentially diagonally to the axis of the work, e.g. "cross" tube-rolling { [Diescher mills](#), [Stiefel disc piercers](#), [Stiefel rotary piercers](#) }
- B21B 19/04
 - .. Rolling basic material of solid, i.e. non-hollow, structure Piercing, { e.g. [rotary piercing mills](#) }
- B21B 19/06
 - .. Rolling hollow basic material, { e.g. [Assel mills](#) } ([B21B 19/04](#) takes precedence; separating work from mandrel [B21C 45/00](#))
- B21B 19/08
 - ... Enlarging tube diameter
- B21B 19/10
 - ... Finishing, e.g. smoothing, sizing, { [reeling](#) }
- B21B 19/12
 - . the axes of the rollers being arranged essentially parallel to the axis of the work
- B21B 19/14
 - .. Rolling tubes by means of additional rollers arranged inside the tubes
- B21B 19/16
 - .. Rolling tubes without additional rollers arranged inside the tubes
- B21B 21/00**

Pilgrim-step tube-rolling, { i.e. [pilger mills](#) }
- B21B 21/005
 - . { with reciprocating stand, e.g. driving the stand }
- B21B 21/02
 - . Rollers therefor
- B21B 21/04
 - . Pilgrim-step feeding mechanisms ([B21B 21/06](#) takes precedence)
- B21B 21/045
 - .. { for reciprocating stands }
- B21B 21/06
 - . Devices for revolving work between the steps
- B21B 21/065
 - .. { for reciprocating stands }
- B21B 23/00**

Tube-rolling not restricted to methods provided for in only one of groups [B21B 17/00](#) , [B21B 19/00](#) , [B21B 21/00](#) , e.g. combined processes { planetary tube rolling, auxiliary arrangements, e.g. lubricating, special tube blanks, continuous casting combined with tube rolling } ([B21B 25/00](#) takes precedence)
- B21B 25/00**

Mandrels for metal tube rolling mills, e.g. mandrels of the types used in the methods covered by group [B21B 17/00](#)
Accessories or auxiliary means therefor; { Construction of, or alloys for, mandrels or plugs }
- B21B 25/02
 - . Guides, supports, or abutments for mandrels, e.g. carriages { or [steadiers](#) }
 - Adjusting devices for mandrels
- B21B 25/04
 - . Cooling or lubricating mandrels during operation
- B21B 25/06
 - . Interchanging mandrels, { [fixing plugs on mandrel rods](#) or cooling during interchanging [mandrels](#) (separating tubes from mandrels [B21C 45/00](#)) }

- B21B 27/00** **Rolls, { roll alloys or roll fabrication } (shape of working surfaces required by special processes [B21B 1/00](#))**
Lubricating, cooling or heating rolls while in use
- [B21B 27/005](#) . { Rolls with a roughened or textured surface; Methods for making same }
- [B21B 27/02](#) . Shape or construction of rolls (for rolling metal of indefinite length in repetitive shapes specially designed for the manufacture of particular objects [B21H 8/02](#)) { ([B21B 27/005](#) takes precedence) }
- [B21B 27/021](#) .. { Rolls for sheets or strips }
- [B21B 27/024](#) .. { Rolls for bars, rods, rounds, tubes, wire or the like }
- [B21B 27/025](#) ... { Skew rolls }
- [B21B 27/027](#) .. { Vertical rolls }
- [B21B 27/028](#) .. { Variable-width rolls }
- [B21B 27/03](#) .. Sleeved rolls { ([B21B 27/028](#) takes precedence) }
- [B21B 27/032](#) ... { Rolls for sheets or strips }
- [B21B 27/035](#) ... { Rolls for bars, rods, rounds, tubes, wire or the like }
- [B21B 27/037](#) { Skew rolls }
- [B21B 27/05](#) ... with deflectable sleeves
- [B21B 27/055](#) { with sleeves radially deflectable on a stationary beam by means of hydraulic supports (in general [F16C 13/00](#) ; for paper-making machines [D21G 1/00](#) ; regulating devices therefor [B21B 37/36](#)) }
- [B21B 27/06](#) . Lubricating, cooling or heating rolls
- [B21B 27/08](#) .. internally
- [B21B 27/10](#) .. externally
- [B21B 27/106](#) ... { Heating the rolls }
- B21B 28/00** **Maintaining rolls or rolling equipment in effective condition (lubricating, cooling or heating rolls while in use [B21B 27/06](#))**
- [B21B 28/02](#) . Maintaining rolls in effective condition, e.g. reconditioning
- [B21B 28/04](#) .. while in use, e.g. polishing { or grinding while the rolls are in their stands }
- B21B 29/00** **Counter-pressure devices acting on rolls to inhibit deflection of same under load, e.g. backing rolls; { Roll bending devices, e.g. hydraulic actuators acting on roll shaft ends (control devices responsive to roll bending [B21B 37/38](#)) }**
- B21B 31/00** **Rolling stand structures**
Mounting, adjusting, or interchanging rolls, roll mountings, or stand frames
- [B21B 31/02](#) . Rolling stand frames { or housings }
Roll mountings; { Roll chocks }
- [B21B 31/028](#) .. { Prestressing of rolls or roll mountings in stand frames }
- [B21B 31/04](#) .. with tie rods { in frameless stands } , e.g. prestressed tie rods

- B21B 31/06 .. Fastening stands or frames to foundation, e.g. to the sole plate (in general [F16M](#))
- B21B 31/07 . Adaptation of roll { neck } bearings (bearings in general [F16C](#))
- B21B 31/074 .. { Oil film bearings, e.g. "Morgoil" bearings }
- B21B 31/076 .. { Cooling; Lubricating roller bearings }
- B21B 31/078 .. { Sealing devices (Sealings in general [F16J 15/00](#)) }
- B21B 31/08 . Interchanging rolls, roll mountings, or stand frames, { e.g. using C-hooks; Replacing roll chocks on roll shafts }
- B21B 31/10 .. by horizontally displacing, { i.e. horizontal roll changing }
- B21B 31/103 ... { Manipulators or carriages therefor }
- B21B 31/106 ... { Vertical displacement of rolls or roll chocks during horizontal roll changing }
- B21B 31/12 .. by vertically displacing
- B21B 31/14 .. by pivotally displacing
- B21B 31/16 . Adjusting { or positioning } rolls (control devices [B21B 37/00](#))
- B21B 31/18 .. by moving rolls axially
- B21B 31/185 ... { and by crossing rolls }
- B21B 31/20 .. by moving rolls perpendicularly to roll axis
- B21B 31/203 ... { Balancing rolls }
- B21B 31/22 ... mechanically, { e.g. by thrust blocks, inserts for removal }
- B21B 31/24 by screws
- B21B 31/26 Adjusting eccentrically-mounted roll bearings
- B21B 31/28 by toggle-lever mechanisms
- B21B 31/30 by wedges or their equivalent
- B21B 31/32 ... by liquid pressure, { e.g. hydromechanical adjusting }
- B21B 33/00** **Safety devices not otherwise provided for** (safety devices in general [F16P](#))
Breaker blocks
Devices for freeing jammed rolls { for handling cobbles; Overload safety devices }
- B21B 33/02 . Preventing fracture of rolls
- B21B 35/00** **Drives for metal-rolling mills, { e.g. hydraulic drives }**
- B21B 35/02 . for continuously-operating mills ([B21B 35/10](#) , [B21B 35/12](#) take precedence)
- B21B 35/025 .. { for stretch-reducing of tubes }
- B21B 35/04 .. each stand having its own motor or motors
- B21B 35/06 . for non-continuously-operating mills or for single stands ([B21B 35/10](#) , [B21B 35/12](#) take precedence)
- B21B 35/08 .. for reversing rolling mills
- B21B 35/10 . Driving arrangements for rolls which have only a low-power drive
Driving arrangements for rolls which receive power from the shaft of another roll

- B21B 35/12
 - . Toothed-wheel gearings specially adapted for metal-rolling mills
 - Housings or mountings therefor
- B21B 35/14
 - . Couplings, driving spindles, or spindle carriers specially adapted for, or specially arranged in, metal-rolling mills ([couplings or shafts in general F16](#))
- B21B 35/141
 - .. { Rigid spindle couplings, e.g. coupling boxes placed on roll necks ([rigid couplings in general F16D 1/00](#)) }
- B21B 35/142
 - .. { Yielding spindle couplings; Universal joints for spindles ([yielding couplings in general F16D 3/00](#)) }
- B21B 35/143
 - ... { having slidably-interengaging teeth, e.g. gear-type couplings ([universal joints with the coupling parts having slidably-interengaging teeth, in general, F16D 3/18](#)) }
- B21B 35/144
 - { Wobbler couplings }
- B21B 35/145
 - ... { Hooke`s joints or the like with each coupling part pivoted with respect to an intermediate member ([Hooke`s joints in general F16D 3/26](#)) }
- B21B 35/146
 - { Tongue and slipper joints ([tongue and slipper joints in general F16D 3/265](#)) }
- B21B 35/147
 - .. { Lubrication of spindle couplings }
- B21B 35/148
 - .. { Spindle carriers or balancers }
- B21B 37/00**
 - Control devices or methods specially adapted for metal-rolling mills or the work produced thereby ([methods or devices for measuring specially adapted for metal-rolling mills B21B 38/00](#))**
- B21B 37/005
 - . { [Control of time interval or spacing between workpieces](#) }
- B21B 37/007
 - . { [Control for preventing or reducing vibration, chatter or chatter marks \(\[B21B 37/66 takes precedence\]\(#\) \)](#) }
- B21B 37/16
 - . Control of thickness, width, diameter or other transverse dimensions ([B21B 37/58 takes precedence](#))
- B21B 37/165
 - .. { [responsive mainly to the measured thickness of the product](#) }
- B21B 37/18
 - .. Automatic gauge control
- B21B 37/20
 - ... in tandem mills
- B21B 37/22
 - .. Lateral spread control
 - Width control, e.g. by edge rolling
- B21B 37/24
 - .. Automatic variation of thickness according to a predetermined programme
- B21B 37/26
 - ... for obtaining one strip having successive lengths of different constant thickness
- B21B 37/28
 - . Control of flatness or profile during rolling of strip, sheets or plates
- B21B 37/30
 - .. using roll camber control
- B21B 37/32
 - ... by cooling, heating or lubricating the rolls
- B21B 37/34
 - ... by hydraulic expansion of the rolls
- B21B 37/36
 - ... by radial displacement of the roll sleeve on a stationary roll beam by means of hydraulic supports
- B21B 37/38
 - .. using roll bending ([B21B 37/42 takes precedence](#))
- B21B 37/40
 - .. using axial shifting of the rolls ([B21B 37/42 takes precedence](#))

- B21B 37/42 . . . using a combination of roll bending and axial shifting of the rolls
- B21B 37/44 . . . using heating, lubricating or water-spray cooling of the product
- B21B 37/46 . Roll speed or drive motor control ([B21B 37/52](#) , [B21B 37/60](#) take precedence)
- B21B 37/48 . Tension control
Compression control
- B21B 37/50 . . . by looper control
- B21B 37/52 . . . by drive motor control
- B21B 37/54 . . . including coiler drive control, e.g. reversing mills
- B21B 37/56 . Elongation control
- B21B 37/58 . Roll-force control
Roll-gap control { ([B21B 38/105](#) takes precedence) }
- B21B 37/60 . . . by control of a motor which drives an adjusting screw
- B21B 37/62 . . . by control of a hydraulic adjusting device
- B21B 37/64 . . . Mill spring or roll spring compensation systems, e.g. control of prestressed mill stands
- B21B 37/66 . . . Roll eccentricity compensation systems
- B21B 37/68 . Camber or steering control for strip, sheets or plates, e.g. preventing meandering
- B21B 37/70 . Length control ([B21B 37/56](#) takes precedence)
- B21B 37/72 . Rear end control
Front end control
- B21B 37/74 . Temperature control, e.g. by cooling or heating the rolls or the product ([B21B 37/32](#) , [B21B 37/44](#) take precedence)
- B21B 37/76 . . . Cooling control on the run-out table
- B21B 37/78 . Control of tube rolling
- B21B 38/00** **Methods or devices for measuring, { detecting or monitoring } specially adapted for metal-rolling mills, e.g. position detection, inspection of the product { (Control devices or methods [B21B 37/00](#)) }**
- B21B 38/006 . { for measuring temperature }
- B21B 38/008 . { Monitoring or detecting vibration, chatter or chatter marks }
- B21B 38/02 . for measuring flatness or profile of strips
- B21B 38/04 . for measuring thickness, width, diameter or other transverse dimensions of the product
- B21B 38/06 . for measuring tension or compression
- B21B 38/08 . for measuring roll-force

- B21B 38/10 . for measuring roll-gap, e.g. pass indicators
- B21B 38/105 .. { Calibrating or presetting roll-gap }
- B21B 38/12 . for measuring roll camber
- B21B 39/00** **Arrangements for moving, supporting, or positioning work, or controlling its movement, combined with or arranged in, or specially adapted for use in connection with, metal-rolling mills (guiding, conveying, or accumulating easily-flexible work in loops or curves [B21B 41/00](#) ; specially associated with cooling-beds [B21B 43/00](#) ; conveying or transporting in general [B65G](#))**
- B21B 39/002 . { Piling, unpling, unscrambling }
- B21B 39/004 . { Transverse moving }
- B21B 39/006 . { Pinch roll sets }
- B21B 39/008 . { Rollers for roller conveyers (roller-ways in general [B65G 13/00](#) , [B21B 39/00](#)) }
- B21B 39/02 . Feeding or supporting work
Braking or tensioning arrangements, { e.g. threading arrangements }
- B21B 39/04 .. Lifting or lowering work for conveying purposes, e.g. tilting tables arranged immediately in front of or behind the pass (turn-over or like manipulating means as such [B21B 39/20](#))
- B21B 39/06 .. Pushing or forcing work into pass
- B21B 39/08 .. Braking or tensioning arrangements
- B21B 39/082 ... { Bridle devices }
- B21B 39/084 ... { Looper devices }
- B21B 39/086 ... { Braking devices }
- B21B 39/088 ... { Bumpers, stopping devices }
- B21B 39/10 .. Arrangement or installation of feeding rollers in rolling stands
- B21B 39/12 .. Arrangement or installation of roller tables in relation to a roll stand
- B21B 39/14 . Guiding, positioning or aligning work ([B21B 43/12](#) takes precedence; guides in which work is subjected to permanent internal twisting [B21B 15/02](#))
- B21B 39/16 .. immediately before entering or after leaving the pass
- B21B 39/165 ... { Guides or guide rollers for rods, bars, rounds, tubes ([B21B 39/28](#) takes precedence) ; Aligning guides }
- B21B 39/18 .. Switches for directing work in metal-rolling mills or trains
- B21B 39/20 . Revolving, turning-over, or like manipulation of work, { e.g. revolving in trio stands } (guides in which work is subjected to permanent internal twisting [B21B 15/02](#))
- B21B 39/22 .. by tipping, e.g. by lifting one side by levers or wedges ([B21B 39/26](#) , [B21B 39/28](#) take precedence)
- B21B 39/223 ... { Side-guard manipulators }
- B21B 39/226 ... { Tilttable ingot chairs }
- B21B 39/24 .. by tongs or grippers

- B21B 39/26 . . by members, e.g. grooved, engaging opposite sides of the work and moved relatively to each other to revolve the work
- B21B 39/28 . . by means of guide members shaped to revolve the work during its passage
- B21B 39/30 . . by lodging it in a rotating ring manipulator or ring segment manipulator
- B21B 39/32 . . Devices specially adapted for turning sheets
- B21B 39/34 . Arrangements or constructional combinations specifically designed to perform functions covered by more than one of groups [B21B 39/02](#) , [B21B 39/14](#) , [B21B 39/20](#)

B21B 41/00 **Guiding, conveying, or accumulating easily-flexible work, e.g. wire, sheet metal bands, in loops or curves**
Loop lifters

- B21B 41/02 . Returning work to repeat the pass or passes { within the same stand }
- B21B 41/04 . . above or underneath the rolling stand or rolls
- B21B 41/06 . in which the direction of movement of the work is turned through approximately 180 degrees, { e.g. repeaters, i.e. from one stand to another }
- B21B 41/08 . without overall change in the general direction of movement of the work
- B21B 41/10 . . Loop deflectors { ([B21B 39/084](#) takes precedence) }
- B21B 41/12 . Arrangements of interest only with respect to provision for indicating or controlling operations

B21B 43/00 **Cooling beds, whether stationary or moving**
Means specially associated with cooling beds, e.g. for braking work or for transferring it to or from the bed (conveying means in general [B65G](#))

- B21B 43/003 . { Transfer to bed }
- B21B 43/006 . { Transfer from bed }
- B21B 43/02 . Cooling beds comprising rakes { racks, walking beams } or bars ([B21B 43/10](#) takes precedence)
- B21B 43/04 . Cooling beds comprising rolls or worms
- B21B 43/06 . Cooling beds comprising carriages ([B21B 43/08](#) takes precedence)
- B21B 43/08 . Cooling beds comprising revolving drums or recycling chains { or discs }
- B21B 43/10 . Cooling beds with other work-shifting elements projecting through the bed
- B21B 43/12 . Devices for positioning workpieces "flushed", i.e. with all their axial ends arranged in line on cooling beds or on co-operating conveyers, { e.g. before cutting }

B21B 45/00 **Devices for surface { or other } treatment of work, specially combined with or arranged in, or specially adapted for use in connection with, metal-rolling mills ([B21B 15/00](#) , { [B21B 1/227](#) and [B21B 27/005](#) } take precedence; technical features of**

scaling-off devices [B21C 43/00](#))

- B21B 45/002 . { Increasing friction between work and working rolls by using friction increasing substance }
- B21B 45/004 . { Heating the product }
- B21B 45/008 . { Heat shields }
- B21B 45/02 . for lubricating, cooling, or cleaning { (in particular in combination with forging or pressing devices [B21B 15/005](#) , control of flatness or profile using lubricating or cooling [B21B 37/44](#)) }
- B21B 45/0203 .. { Cooling }
- B21B 45/0206 ... { Coolants }
- B21B 45/0209 ... { Cooling devices, e.g. using gaseous coolants }
- B21B 45/0215 { using liquid coolants, e.g. for sections, for tubes }
- B21B 45/0218 { for strips, sheets, or plates ([B21B 45/023](#) , [B21B 45/0233](#) take precedence) }
- B21B 45/0224 { for wire, rods, rounds, bars ([B21B 45/023](#) , [B21B 45/0233](#) take precedence) }
- B21B 45/023 { by immersion in a bath }
- B21B 45/0233 { Spray nozzles, Nozzle headers; Spray systems }
- B21B 45/0239 .. { Lubricating }
- B21B 45/0242 ... { Lubricants }
- B21B 45/0245 ... { Lubricating devices }
- B21B 45/0248 { using liquid lubricants, e.g. for sections, for tubes }
- B21B 45/0251 { for strips, sheets, or plates }
- B21B 45/0257 { for wire, rods, rounds, bars }
- B21B 45/0263 { using solid lubricants }
- B21B 45/0266 .. { Measuring or controlling thickness of liquid films }
- B21B 45/0269 .. { Cleaning }
- B21B 45/0272 ... { Cleaning compositions }
- B21B 45/0275 ... { Cleaning devices }
- B21B 45/0278 { removing liquids }
- B21B 45/0281 { removing coolants }
- B21B 45/0284 { removing lubricants }
- B21B 45/0287 { removing solid particles, e.g. dust, rust }
- B21B 45/029 ... { Liquid recovering devices }
- B21B 45/0293 { Recovering coolants }
- B21B 45/0296 { Recovering lubricants }
- B21B 45/04 . for de-scaling, { e.g. by brushing ([descaling of rod or wire B21C 43/04](#)) }
- B21B 45/06 .. of strip material ([B21B 45/08](#) takes precedence)
- B21B 45/08 .. hydraulically

B21B 47/00 **Auxiliary arrangements, devices or methods in connection with rolling of multi-layer sheets of metal ([soaking pits C21D 9/70](#))**

[B21B 47/02](#) . for folding sheets before rolling

[B21B 47/04](#) . for separating layers after rolling

B21B 99/00 **Subject matter not provided for in other groups of this subclass**

Guide heading:

B21B 2001/00 **Metal-rolling methods or mills for making semi-finished products of solid or profiled cross-section ([B21B 17/00](#) to [B21B 23/00](#) take precedence; with respect to composition of material to be rolled [B21B 3/00](#) ; extending closed shapes of metal bands by simultaneous rolling at two or more zones [B21B 5/00](#) ; metal-rolling stands as units [B21B 13/00](#) ; continuous casting into moulds having walls formed by moving rolls [B22D 11/06](#))**

Sequence of operations in milling trains

Layout of rolling-mill plant, e.g. grouping of stands

Succession of passes or of sectional pass alternations

[B21B 2001/02](#) . for rolling heavy work, e.g. ingots, slabs, { blooms } billets, in which the cross-sectional form is unimportant { [Rolling combined with forging or pressing](#) }

[B21B 2001/022](#) . . Blooms or billets

[B21B 2001/028](#) . . Slabs

[B21B 2001/08](#) . for rolling { [structural sections, i.e.](#) } work of special cross-section, e.g. angle steel ([rolling metal of indefinite length in repetitive shapes specially designed for the manufacture of particular objects B21H 8/00](#))

[B21B 2001/081](#) . . Roughening or texturing surfaces of structural sections, bars, rounds, wire rods

[B21B 2001/22](#) . for rolling { [plates, strips,](#) } bands or sheets of indefinite length ([B21B 1/42](#) takes precedence)

[B21B 2001/221](#) . . by cold-rolling

[B21B 2001/225](#) . . by hot-rolling

[B21B 2001/228](#) . . skin pass rolling or temper rolling

[B21B 2001/38](#) . for rolling sheets of limited length, e.g. folded sheets, superimposed sheets, { [pack rolling](#) } ([B21B 1/40](#) takes precedence; folding sheets before, or separating layers after, rolling [B21B 47/00](#))

[B21B 2001/383](#) . . Cladded or coated products

[B21B 2001/386](#) . . Plates

B21B 2003/00 **Rolling materials of special alloys so far as the composition of the alloy requires or permits special rolling methods or sequences { [Rolling of aluminium, copper, zinc or other non-ferrous metals](#) } ([altering special metallurgical properties of alloys, other than structure consolidation or mechanical properties resulting therefrom C21D](#) , [C22F](#))**

B21B 2003/001	. Aluminium or its alloys
B21B 2003/005	. Copper or its alloys
B21B 2003/006	. Powder metal alloys
B21B 2003/008	. Zinc or its alloys
B21B 2013/00	Metal-rolling stands, i.e. an assembly composed of a stand frame, rolls, and accessories (B21B 17/00 to B21B 23/00 take precedence; details, component parts, accessories, auxiliary means, procedures in connection with metal rolling, see the relevant groups)
B21B 2013/003	. Inactive rolling stands
B21B 2013/006	. Multiple strand rolling mills Mill stands with multiple caliber rolls
B21B 2013/02	. with axes of rolls arranged horizontally
B21B 2013/021	.. Twin mills
B21B 2013/025	.. Quarto, four-high stands
B21B 2013/026	.. Quinto, five high-stands
B21B 2013/028	.. Sixto, six-high stands
B21B 2013/08	. with differently-directed roll axes, e.g. for the so-called "universal" rolling process
B21B 2013/10	.. all axes being arranged in one plane
B21B 2013/106	... for sections, e.g. beams, rails
B21B 2015/00	Arrangements for performing additional metal-working operations specially combined with or arranged in, or specially adapted for use in connection with, metal-rolling mills
B21B 2015/0007	. { Cutting or shearing the product }
B21B 2015/0014	.. transversely to the rolling direction
B21B 2015/0021	.. in the rolling direction
B21B 2015/0028	. Drawing the rolled product
B21B 2015/0057	. Coiling the rolled product
B21B 2015/0064	. Uncoiling the rolled product
B21B 2015/0071	. Levelling the rolled product
B21B 2015/0078	. Extruding the rolled product
B21B 2015/0092	. Welding in the rolling direction

- B21B 2023/00** **Tube-rolling not restricted to methods provided for in only one of groups [B21B 17/00](#) , [B21B 19/00](#) , [B21B 21/00](#) , e.g. combined processes { planetary tube rolling, auxiliary arrangements, e.g. lubricating, special tube blanks, continuous casting combined with tube rolling } ([B21B 25/00](#) takes precedence)**
- [B21B 2023/005](#) . Roughening or texturing surfaces of tubes
- B21B 2027/00** **Rolls, { roll alloys or roll fabrication } (shape of working surfaces required by special processes [B21B 1/00](#))**
Lubricating, cooling or heating rolls while in use
- [B21B 2027/02](#) . Shape or construction of rolls (for rolling metal of indefinite length in repetitive shapes specially designed for the manufacture of particular objects [B21H 8/02](#)) { ([B21B 27/005](#) takes precedence) }
- [B21B 2027/021](#) . . { Rolls for sheets or strips }
- [B21B 2027/022](#) . . . Rolls having tapered ends
- [B21B 2027/06](#) . Lubricating, cooling or heating rolls
- [B21B 2027/08](#) . . internally
- [B21B 2027/083](#) . . . cooling internally
- [B21B 2027/086](#) . . . heating internally
- [B21B 2027/10](#) . . externally
- [B21B 2027/103](#) . . . cooling externally
- B21B 2031/00** **Rolling stand structures**
Mounting, adjusting, or interchanging rolls, roll mountings, or stand frames
- [B21B 2031/02](#) . Rolling stand frames { or housings }
Roll mountings; { Roll chocks }
- [B21B 2031/021](#) . . Integral tandem mill housings
- [B21B 2031/023](#) . . Transverse shifting one housing
- [B21B 2031/025](#) . . Shifting the stand in or against the rolling direction
- [B21B 2031/026](#) . . Transverse shifting the stand
- [B21B 2031/07](#) . Adaptation of roll { neck } bearings (bearings in general [F16C](#))
- [B21B 2031/072](#) . . Bearing materials
- [B21B 2031/16](#) . Adjusting { or positioning } rolls (control devices [B21B 37/00](#))
- [B21B 2031/20](#) . . by moving rolls perpendicularly to roll axis
- [B21B 2031/206](#) . . . Horizontal offset of work rolls
- B21B 2033/00** **Safety devices not otherwise provided for (safety devices in general [F16P](#))**
Breaker blocks
Devices for freeing jammed rolls { for handling cobbles; Overload safety devices }
- [B21B 2033/005](#) . Cobble-freeing

B21B 2035/00	Drives for metal-rolling mills, { e.g. hydraulic drives }
B21B 2035/005	. Hydraulic drive motors
B21B 2035/10	. Driving arrangements for rolls which have only a low-power drive Driving arrangements for rolls which receive power from the shaft of another roll
B21B 2035/103	.. Fluid-driven rolls or rollers
B21B 2035/106	.. Non-driven or idler rolls or rollers
B21B 2035/14	. Couplings, driving spindles, or spindle carriers specially adapted for, or specially arranged in, metal-rolling mills (couplings or shafts in general F16)
B21B 2035/149	.. Measuring devices for spindles or couplings
B21B 2037/00	Control devices or methods specially adapted for metal-rolling mills or the work produced thereby (methods or devices for measuring specially adapted for metal-rolling mills B21B 38/00)
B21B 2037/002	. Mass flow control
B21B 2038/00	Methods or devices for measuring, { detecting or monitoring } specially adapted for metal-rolling mills, e.g. position detection, inspection of the product { (Control devices or methods B21B 37/00) }
B21B 2038/002	. Measuring axial forces of rolls
B21B 2038/004	. Measuring scale thickness
B21B 2045/00	Devices for surface { or other } treatment of work, specially combined with or arranged in, or specially adapted for use in connection with, metal-rolling mills (B21B 15/00 , { B21B 1/227 and B21B 27/005 } take precedence; technical features of scaling-off devices B21C 43/00)
B21B 2045/004	. { Heating the product }
B21B 2045/006	.. in vacuum or in inert atmosphere
B21B 2045/02	. for lubricating, cooling, or cleaning { (in particular in combination with forging or pressing devices B21B 15/005 , control of flatness or profile using lubricating or cooling B21B 37/44) }
B21B 2045/0203	.. { Cooling }
B21B 2045/0209	... { Cooling devices, e.g. using gaseous coolants }
B21B 2045/0212	.... using gaseous coolants
B21B 2045/0215	.... { using liquid coolants, e.g. for sections, for tubes }
B21B 2045/0221	..... for structural sections, e.g. H-beams
B21B 2045/0227	..... for tubes
B21B 2045/0236	.. Laying heads for overlapping rings on cooling conveyer
B21B 2045/0239	.. { Lubricating }

B21B 2045/0245	...	{ Lubricating devices }
B21B 2045/0248	....	{ using liquid lubricants, e.g. for sections, for tubes }
B21B 2045/0254	.....	for structural sections, e.g. H-beams
B21B 2045/026	.....	for tubes

Guide heading:**B21B 2201/00 Special rolling modes**

B21B 2201/02	. Austenitic rolling
B21B 2201/04	. Ferritic rolling
B21B 2201/06	. Thermomechanical rolling
B21B 2201/08	. Batch rolling
B21B 2201/10	. Endless rolling
B21B 2201/12	. Isothermic rolling
B21B 2201/14	. Soft reduction
B21B 2201/16	. Two-phase or mixed-phase rolling
B21B 2201/18	. Vertical rolling pass lines

Guide heading: Equipment codes**B21B 2203/00 Auxiliary arrangements, devices or methods in combination with rolling mills or rolling methods**

B21B 2203/02	. Backlash elimination
B21B 2203/04	. Brakes
B21B 2203/06	. Cassettes
B21B 2203/08	. Clutches
B21B 2203/10	. Counterweights
B21B 2203/12	. Covers or shieldings
B21B 2203/14	. Dummy bars or slabs
B21B 2203/16	. Eccentrics

B21B 2203/18	. Rolls or rollers
B21B 2203/182	.. Fluid driven rolls or rollers
B21B 2203/185	.. Reversible rolls for changing grooves
B21B 2203/187	.. Tilting rolls
B21B 2203/20	. Flywheels
B21B 2203/22	. Hinged chocks
B21B 2203/24	. Hydrostatic bearings or guides
B21B 2203/26	. Motors, drives
B21B 2203/28	. Mounting or dismounting bearing and chock as a unit
B21B 2203/30	. Quick or bayonet couplings
B21B 2203/32	. Roll changing stools
B21B 2203/34	. Rotational position or alignment
B21B 2203/36	. Spacers
B21B 2203/38	. Strain gauges
B21B 2203/40	. Torsion bars or shafts
B21B 2203/42	. Turntables
B21B 2203/44	. Vibration dampers
B21B 2205/00	Particular shaped rolled products
B21B 2205/02	. Tailored blanks
B21B 2205/04	. Taper- or wedge-shaped profiles
B21B 2261/00	Product parameters
B21B 2261/02	. Transverse dimensions
B21B 2261/04	.. Thickness, gauge
B21B 2261/043	... Blanks with variable thickness in the rolling direction
B21B 2261/046	... Different thickness in width direction
B21B 2261/05	... Different constant thicknesses in one rolled product
B21B 2261/06	.. Width
B21B 2261/065	... Blanks with variable width
B21B 2261/08	.. Diameter

B21B 2261/10	. . Cross-sectional area
B21B 2261/12	. Length
B21B 2261/14	. Roughness
B21B 2261/18	. Weight
B21B 2261/20	. Temperature
B21B 2261/21	. . Temperature profile
B21B 2261/22	. Hardness
B21B 2263/00	Shape of product
B21B 2263/02	. Profile, e.g. of plate, hot strip, sections
B21B 2263/04	. Flatness
B21B 2263/06	. . Edge waves
B21B 2263/08	. . Centre buckles
B21B 2263/10	. Lateral spread defects
B21B 2263/12	. . Dog bone
B21B 2263/16	. Alligatoring
B21B 2263/20	. End shape fish tail tongue
B21B 2263/30	. Shape in top view
B21B 2265/00	Forming parameters
B21B 2265/02	. Tension
B21B 2265/04	. . Front or inlet tension
B21B 2265/06	. . Interstand tension
B21B 2265/08	. . Back or outlet tension
B21B 2265/10	. Compression, e.g. longitudinal compression
B21B 2265/12	. Rolling load or rolling pressure roll force
B21B 2265/14	. Reduction rate
B21B 2265/16	. . Extension
B21B 2265/18	. Elongation

B21B 2265/20	. Slip
B21B 2265/22	. Pass schedule
B21B 2265/24	. asymmetric rolling
B21B 2267/00	Roll parameters
B21B 2267/02	. Roll dimensions
B21B 2267/06	. . Roll diameter
B21B 2267/065	. . . Top and bottom roll have different diameters Asymmetrical rolling
B21B 2267/08	. . Roll eccentricity
B21B 2267/10	. Roughness of roll surface
B21B 2267/12	. Roll temperature
B21B 2267/18	. Roll crown roll profile
B21B 2267/19	. . Thermal crown
B21B 2267/20	. . Ground camber or profile
B21B 2267/22	. . Hydraulic expansion of rolls
B21B 2267/24	. Roll wear
B21B 2267/26	. Hardness of the roll surface
B21B 2267/28	. Elastic moduli of rolls
B21B 2269/00	Roll bending or shifting
B21B 2269/02	. Roll bending vertical bending of rolls
B21B 2269/04	. . Work roll bending
B21B 2269/06	. . Intermediate roll bending
B21B 2269/08	. . Back-up roll bending
B21B 2269/10	. Horizontal bending of rolls
B21B 2269/12	. Axial shifting the rolls
B21B 2269/14	. . Work rolls
B21B 2269/16	. . Intermediate rolls
B21B 2269/18	. . Back-up rolls
B21B 2271/00	Mill stand parameters

- B21B 2271/02 . Roll gap, screw-down position, draft position
- B21B 2271/025 . . Tapered roll gap
- B21B 2271/04 . . Screw-down speed, draft speed
- B21B 2271/06 . Mill spring

B21B 2273/00 Path parameters

- B21B 2273/02 . Vertical deviation, e.g. slack, looper height
- B21B 2273/04 . Lateral deviation, meandering, camber of product
- B21B 2273/06 . Threading
- B21B 2273/08 . . Threading-in or before threading-in
- B21B 2273/10 . . Threading-out or after threading-out
- B21B 2273/12 . End of product
- B21B 2273/14 . . Front end or leading end
- B21B 2273/16 . . Tail or rear end
- B21B 2273/18 . Presence of product
- B21B 2273/20 . Track of product
- B21B 2273/22 . Aligning on rolling axis, e.g. of roll calibers
- B21B 2273/24 . Web positioning

B21B 2275/00 Mill drive parameters

- B21B 2275/02 . Speed
- B21B 2275/04 . . Roll speed
- B21B 2275/05 . . . Speed difference between top and bottom rolls
- B21B 2275/06 . . Product speed
- B21B 2275/08 . . Coiler speed
- B21B 2275/10 . Motor power
motor current
- B21B 2275/12 . . Roll torque